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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/960,508	09/24/2001	Ralph W. Bennett		7228

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J. WILEY HORTON, ESQUIRE
Pennington, Moore, Wilkinson, Bell & Dunbar, P.A.
Post Office Box 10095
Tallahasse, FL 32302-2095

EXAMINER
YAM, STEPHEN K

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 08/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/960,508	Applicant(s) BENNETT ET AL.	
	Examiner Stephen Yam	Art Unit 2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-11 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-11 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 24 September 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 4, 5, and 10 are rejected under 35 U.S.C. 102(b) as being unpatentable by Hecker et al. US Patent No. 4,775,235.

Regarding Claim 1, Hecker et al. teach (see Fig. 1) a device for determining the distance from a fixed position to a plurality of points on the surface of a target object (9) comprising:

a. a laser (2), positioned proximate said fixed position, with its beam (10) directed towards said target object as to create an impact point (16) on said target object;

b. a video camera (1), positioned proximate said laser, and fixed in position with respect to said laser, with the field of view (11) of said video camera directed towards said impact point;

c. measurement means (1B) capable of accurately measuring the position of said impact point within said field of view of said video camera;

d. computation means (see Col. 4, line 63 to Col. 5, line 15) for calculating the distance from said fixed position to said impact point on the basis of said measured position of said impact point within said field of view of said video camera; and

e. oscillation means (3) for oscillating said beam and said video camera field of view in synchronization (see Col. 4, lines 26-35) so as to sweep said beam of said laser and said field of view of said camera across said target object while maintaining said impact point within said field of view of said video camera, so as to permit (see Col. 4, lines 26-29) the computation of distances for a plurality of said impact points on said target object.

Regarding Claim 4, Hecker et al. teach (see Fig. 1) a device for determining the distance from a fixed position to a plurality of points on the surface of a target object (9) comprising:

a. a laser (2), positioned proximate said fixed position, with its beam (reflected off mirror (4)) not directed towards said target object;

b. a video camera (1), positioned proximate said laser, and fixed in position with respect to said laser, with the field of view (14) of said video camera pointed in the same direction as said beam;

c. a galvanometer (3), having an oscillating shaft extending therefrom, and being positioned proximate said laser, with said oscillating shaft being oriented to obstruct the path of said beam and said field of view of said video camera;

d. a mirror (4), fixedly attached to said oscillating shaft, and positioned as to reflect said beam and said camera field of view out towards said target object, so that said beam

creates an impact point (16) on said target object which falls within said field of view of said camera, and so that an oscillation of said oscillating shaft causes the oscillation of said mirror, thereby causing said impact point and said camera field of view to sweep across said target object in synchronization;

e. measurement means (1B) capable of accurately measuring the position of said impact point within said field of view of said video camera;

f. computation means (see Col. 4, line 63 to Col. 5, line 15) for calculating the distance from said fixed position to said impact point on the basis of said measured position of said impact point within said field of view of said video camera; and

Regarding Claims 2 and 5, Hecker et al. teaches said video camera as a line scan camera (see Fig. 2 and Col. 4, line 63 to Col. 5, line 5).

Regarding Claim 10, Hecker et al. teach (see Fig. 1) a device for determining the distance from a fixed position to a plurality of points on the surface of a target object (9) comprising:

a. a common mirror (4);

b. a laser (2), positioned so as to direct a beam (13) upon said common mirror and from thence out (10) to said target object;

c. a camera (1), offset a set distance from said laser, and positioned so as to view the impact point (16) of said beam upon said target object through its reflection (14) in said common mirror;

d. means for oscillating (3) said common mirror through a set arc, thereby moving said impact point of said beam up and down upon said target object, and also moving the field of view of said camera in unison with said impact point so that said impact point is always within said field of view of said camera;

e. means for measuring (1B) the position of said impact point within said field of view of said camera; and

f. computation means (see Col. 4, line 63 to Col. 5, line 15) for calculating the distance from said shaft to said impact point using said set separation distance and said position of said impact point within said field of view of said camera.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 3, 6-9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hecker et al.

Regarding Claims 3 and 6, Hecker et al. teach a device for determining the distance from a fixed position to a plurality of points on the surface of a target object comprising a laser, a video camera, measurement means, and computation means. Regarding Claim 3, Hecker et al. also teach oscillation means for oscillating the laser beam and the video camera field of view in synchronization. Regarding Claim 6, Hecker et al. also teach a galvanometer having an

oscillating shaft extending therefrom and a mirror fixedly attached to the oscillating shaft. Hecker et al. also teach (see Col. 4, lines 54-56) the processing of the camera outputs to develop a three-dimensional relationship of the surface. Hecker et al. do not teach memory means for storing said computing distances to said impact points in order to create a surface model of said target object. It is well known in the art to use memory as a storage medium for retaining previously accumulated data. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include memory means for storing the computing distances to the impact points in order to create a surface model of the target object in the device of Hecker et al., to store previous data values so an entire three-dimensional surface model can be generated through the collection of multiple data points, to provide comparison means between two three-dimensional objects.

Regarding Claim 7, Hecker et al. teach (see Fig. 1) a device for determining the distance from a fixed position to a plurality of points on the surface of a target object (9) comprising a mirror (4), a laser (2) positioned so as to direct a beam upon the mirror and from thence out to said target object, a camera (1) positioned so as to view the impact point (16) of said beam upon said target object through its reflection in the mirror, means (3) for oscillating the mirror through a set arc, thereby moving said impact point of said beam up and down upon said target object, means (1B) for measuring the position of said impact point within said field of view of said camera, and computation means (see Col. 4, line 63 to Col. 5, line 15) for calculating the distance from said shaft to said impact point using said set separation distance and said position of said impact point within said field of view of said camera. Hecker et al. do not teach a separate laser mirror and camera mirror offset a set separation distance from the laser mirror and

linked to said laser mirror so as to move in unison with said laser mirror. It is design choice to include two separate mirrors instead of a single common mirror. It would have been obvious to one of ordinary skill in the art at the time the invention was made to separate the mirror into a laser mirror and camera mirror in the device of Hecker et al., to allow easier and more economical replacement of a mirror in the event of damage to a single mirror.

Regarding Claim 8, Hecker et al. teaches the device as taught in the preceeding paragraph with respect to Claim 7. Hecker et al. also teach (see Col. 4, lines 54-56) the processing of the camera outputs to develop a three-dimensional relationship of the surface. Hecker et al. does not teach memory storage means to record a plurality of computed distance measurements in order to build a mathematical profile of said target object. It is well known in the art to use memory as a storage medium for retaining previously accumulated data. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include memory storage means to record a plurality of computer distance measurements in order to build a mathematical profile of the target object in the device of Hecker et al., to store previous data values so an entire three-dimensional mathematical model can be generated through the collection of multiple data points, to provide comparison means between two three-dimensional objects.

Regarding Claim 11, Hecker et al. teach (see Fig. 1) a device for determining the distance from a fixed position to a plurality of points on the surface of a target object (9) comprising a common mirror (4), a set of two mirrors (6, 7) with each mirror facing a different angle, a projector mirror (5) offset a set distance from said first angled side of said splitting mirror, a receiver mirror (8) offset a set distance from said second angled side of said splitting mirror, a laser (2) positioned so as to direct a beam upon said common mirror and from thence upon a first

mirror (6) in the set of two mirrors, and from thence upon said projector mirror, and from thence out to said target object, a camera (1) positioned so as to view the impact point of said beam upon said target object through its reflection in said receiver mirror, a second mirror (7) in the set of two mirrors, and said common mirror, means for oscillating (3) said common mirror through a set arc, thereby moving said impact point of said beam up and down upon said target object, and also moving the field of view of said camera in unison with said impact point so that said impact point is always within said field of view of said camera, means for measuring (1B) the position of said impact point within said field of view of said camera, and computation means (see Col. 4, line 63 to Col. 5, line 15) for calculating the distance from said shaft to said impact point using said set separation distance and said position of said impact point within said field of view of said camera. Hecker et al. do not teach the first (6) and second (7) mirror in the set of two mirrors (6, 7) as a single splitting mirror having a first angled side and a second angled side. It is design choice to incorporate two separate mirrors as a single mirror having the same reflective areas. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include a splitting mirror having a first angled side and a second angled side in the device of Hecker et al., to simplify the manufacturing and durability of the device by having fewer and larger components which are easier to construct and less likely to damage, as opposed to an increased number of relatively smaller components.

4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hecker et al. in view of Cantor US Patent No. 4,198,164.

Hecker et al. teaches the device as taught in the preceding rejection of Claim 8. Hecker et al. do not teach the target object moving past the laser mirror in a controlled fashion and wherein the linear motion of said target object is sensed by sensing means so that a plurality of said mathematical profiles of said target object can be computer, thereby allowing the computation of a full surface mode. Cantor teaches (see Fig. 1) a distance measurement device with a laser (13, 14) directed on a target object (1), a camera (12) to view the impact point of the laser, means for measuring (27) the position of said impact point within said impact point within said field of view of said camera, and computation means (see Col. 4, line 50 to Col. 5, line 4) for calculating the distance from the camera to the impact point using the set separation distance and the position of the impact point within the field of view of the camera. Cantor also teaches the laser and camera mounted on a housing (10) and the controlled movement of the target object relative to the housing (see Col. 2, lines 46-48 and Col. 9, lines 1-3)- hence, in the view of the camera, the target object is moved past the camera. It is design choice whether the target object is moved relative to the camera or the camera is moved relative to the target object, and such a decision does not affect the operation and performance of the device. Although Cantor does not specifically mention a sensing means for the linear motion of the target object, it is inherent that the precise calibrated motion involved in the device of Cantor requires a linear motion sensing means such as a speedometer. It would have been obvious to one of ordinary skill in the art at the time the invention was made to move the target object past the laser mirror in a controlled fashion wherein the linear motion of said target object is sensed by sensing means so that a plurality of said mathematical profiles of said target object can be computer, allowing the computation of a full surface mode in the device of Hecker et al. in view of Cantor, to provide

additional flexibility in scanning various surface points in the longitudinal direction to obtain a complete three-dimensional profile of the target object.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hasegawa et al. US Patent No. 5,523,844, teach a displacement sensor for measuring distance to a target object using a laser and a camera.

Homma et al. US Patent No. 4,878,754, teach a displacement sensor for measuring distance to a target object using a laser and a camera with means for movement in the horizontal direction.

Frankel et al. US Patent No. 4,745,290, teach a distance measurement device with a laser, camera, and galvanometer to vary the deflection of the incident and reflected beams.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen Yam whose telephone number is (703)306-3441. The examiner can normally be reached on Monday-Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached on (703)308-4881. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7724 for regular communications and (703)308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

SY S.Y.
August 12, 2002

STEPHONE ALLEN
PRIMARY EXAMINER